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**FINTECH AND FINANCIAL LITERACY
IN VIET NAM**

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Abstract

Financial literacy is gaining increasing importance as a policy objective in many countries. A growing literature has examined the role of financial literacy in an individual's income, saving behavior, and the use of various financial products. However, so far, we are not aware of any studies of the relationship between financial literacy and the awareness and adoption of financial technology (fintech) products, i.e., financial products provided via internet-based and mobile-based platforms especially in developing countries. This paper examines this relationship in a developing country, Viet Nam. To do so, we conducted a survey on financial literacy and fintech awareness and adoption, using financial literacy questions to calculate a financial literacy score. We find that a higher level of financial literacy has strong and positive effects on an individual's awareness and use of fintech products.

Contents

1. INTRODUCTION

Financial literacy has gained an important position in the policy agenda of many countries, and the importance of collecting informative, reliable data on the levels of financial literacy across the adult population has been widely recognized (OECD/INFE 2015b). This parallels the emphasis placed on increasing financial inclusion, i.e., the access of individuals and firms to financial products and services. If individuals do not understand financial principles, they will not be able to profit from such increased access. Also, the trend of switching to defined-contribution plans from defined-benefit pension plans implies that individuals will increasingly need to manage their own retirement savings and pensions. At their summit in Los Cabos, Mexico in 2012, Group of Twenty (G20) leaders endorsed the High-Level Principles on National Strategies for Financial Education developed by the OECD/INFE, thereby acknowledging the importance of coordinated policy approaches to financial education (G20 2012). At the same time, surveys consistently show that the level of financial literacy is relatively low, even in advanced economies (OECD/INFE 2016, 2017, 2018). This indicates that the need for higher levels of financial literacy is increasing.

Rapid developments in financial technology (fintech) also highlight the need to improve financial literacy in order to use innovative financial products and services. With the development of information–communication technology (ICT), there is a growing breed of fintech companies that provide services through internet- and mobile-based platforms such as Ant Financial (People's Republic of China), Grab (Singapore), Paytm (India), Compass (US), and Opendoor (UK). Recent literature has shown that fintech (especially mobile money) has helped to increase financial inclusion in developing economies where the traditional bank-based financial system is underdeveloped (Demirguc-Kunt et al. 2018). Other studies have identified factors that affect the adoption of mobile- and internet-based financial services (Jack, Ray, and Suri 2013; Suri 2017). However, we are not aware of any papers that investigate the role of financial literacy on the awareness and/or use of fintech products.

This paper attempts to fill this gap by using newly collected data in a developing country, Viet Nam. Our research question is whether those with a higher level of financial literacy are more likely to be aware of and use fintech products. To answer this question, we construct a financial literacy[1] score based on the approach of the OECD/INFE (2015a, 2015c) and use both ordinary least squares (OLS) and Heckman two-step procedure estimation. We find that higher financial literacy is significantly related to both awareness and adoption of fintech products. Therefore, improvements in financial literacy could speed the adoption of fintech products and services, and thereby promote financial inclusion.

The paper is organized as follows. Section 2 provides some background on fintech development in general, and in Viet Nam in particular. Section 3 reviews the literature on the effects of financial literacy. Data collection, the definition of the financial literacy score used in this study, and some descriptive analyses are presented in Section 4. Econometric methodologies and results are reported in Section 5, followed by some concluding remarks in Section 6.

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[1] While financial literacy, as explained above, is multi-dimensional, including financial knowledge, financial behavior, and financial attitude, most of the literature has defined financial knowledge to be equivalent to financial literacy, ignoring the other dimensions. In this version of this paper, we adopt this more limited definition and use financial knowledge and financial literacy interchangeably.

2. FINTECH AND FINTECH DEVELOPMENT IN THE ASSOCIATION OF SOUTHEAST ASIAN NATIONS

2.1 An Overview of Fintech

"Fintech" refers to "any technological innovation in—and automation of—the financial sector, including advances in financial literacy, advice and education, as well as streamlining of wealth management, lending and borrowing, retail banking, fundraising, money transfers/payments, investment management and more" (Investopedia 2018). Earlier generations of finance-related technology typically focused on providing services to already-established financial firms, but today's fintech companies are increasingly providing services directly to consumers. Fintech is changing finance in fundamental ways, from investment management to capital–raising, to the very form of currency itself. In each of these areas, fintech innovation has lowered the barriers to entry, expanded access to financial services, and challenged the traditional understanding of how finance works.

Major categories of financial services offered by fintech firms include:

- Payments and transfers (e-commerce payments; mobile banking; mobile wallets; person-to-person (P2P) payments and transfers; digital currency; and cross-border transactions including remittances and business-to-business (B2B) payments)

- Personal finance (robo-advisors; mobile trading; and personal financial management)

- Alternative financing (crowdfunding; alternative lending; and invoice and supply-chain finance); and

- Others (insurance products, etc.)

Table 1 provides an overview of the size, composition, and regulatory status of fintech markets in some Association of Southeast Asian Nations (ASEAN) economies.

Table 1: Fintech in ASEAN: A Snapshot

	No. of Fintech Companies	Investment in 2017 (USD million)	Key Sectors	Regulatory Sandbox
Indonesia	262	26 (370% yoy growth)	Mobile payments, alternative lending	Yes
Malaysia	196	75 (1,500% yoy growth)	Payments, consumer finance	Yes
Philippines	115	78 (1,300% yoy growth)	Payments (incl. remittances)	Yes
Singapore	490	141 (68% yoy growth)	Wealth management, alternative lending, payments	Yes
Thailand	128	12 (–40% yoy growth)	Payments	Yes
Viet Nam	153	3	Payments	No

Note: yoy = year-on-year.
Source: EY (2018).

2.2 Fintech Development in Viet Nam

Digital financial services are at a very nascent stage in Viet Nam. Mobile "top ups" and bill payments for some services such as electricity and water through a formal bank account, the internet, or cell phones are the most widely used services.

Internet Infrastructure in Viet Nam

Mobile connectivity has grown rapidly in Viet Nam since 2005. About 60–70% of the population have access to the internet either though computer or mobile phone. The mobile network has upgraded to 4G and 5G will be implemented from 2020 onward.

In recent years, the environment in Viet Nam for internet startups, including fintech startups, has eased. Together with internet startups, the number of fintech firms increased significantly from about 70 in 2016 to about 150 firms in 2019[2]. However, the services they provide are rather limited, mostly e-wallets and payment facilitators. Some fintech firms provide robo-advisor services for stock and forex trading.

3. LITERATURE SURVEY

In the literature, there are several widely used definitions of financial literacy. In their review article, Lusardi and Mitchell (2014) define financial literacy as "peoples' ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions." The Organization for Economic Cooperation and Development and the International Network on Financial Education (OECD/INFE 2016) define financial literacy as "[a] combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial wellbeing." Thus, this concept of financial literacy is multi-dimensional, reflecting not only knowledge but also skills, attitudes, and actual behavior.

The literature on financial literacy focuses on two main areas: (i) the determinants of financial literacy, including age, gender, level of education, and occupation; and (ii) the effects of financial knowledge on various aspects of financial behavior, including saving, use of credit, preparation for retirement, and awareness and adoption of various financial services. Here we focus on the latter area.

There is a well-developed literature trying to link measures of financial literacy with other economic and financial behaviors, going back to Bernheim (1995, 1998) in the United States, in response to the increasing shift toward defined-contribution pension plans. This area of research received a further boost after the global financial crisis of 2008–2009, which drew attention to numerous scams inflicted on individual borrowers and investors in the United States and other countries. Hilgert, Hogarth, and Beverly (2003) found a strong correlation between financial literacy and daily financial management skills, while other studies found that people who were more numerate and financially literate are more likely to participate in financial markets and invest in stocks and make precautionary savings (Christelis, Jappelli, and Padula 2010; van Rooij, Lusardi, and Alessie 2011; de Bassa Scheresberg 2013). People who are more financially savvy are also more likely to undertake retirement planning, and those who plan also accumulate more wealth (Lusardi and Mitchell 2011). These results have been

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[2] Vietnam News "Fintech firms need clear policy to develop," available at https://vietnamnews.vn/economy/524301/fintech-firms-need-clear-policy-to-develop.html

corroborated in a number of countries. The work of Mahdzan and Tabiani (2013) is an example of this kind of research in Malaysia.

On the liability side of the household balance sheet, Moore (2003) found that the least financially literate are more likely to have more expensive mortgages. Campbell (2006) showed that those with lower income and less education were less likely to refinance their mortgages during periods of falling interest rates. Stango and Zinman (2009) found that those unable to correctly calculate interest rates generally borrowed more and accumulated less wealth.

The likelihood of participation in a risky financial behavior is crucially affected by the costs and benefits of acquiring information (Hsiao and Tsai 2018). Vissing-Jorgensen (2003) and Guiso and Jappelli (2005) suggest that awareness and understanding of financial products will influence one's decision on whether or not to use those products. Van Rooij et al. (2011) show that financial literacy has a positive correlation with stock market participation. Individuals with higher financial literacy may have lower fixed costs associated with acquiring and processing financial information than those with lower financial literacy, which would make it easier for the former to participate in risky financial activities. Similar to stock market participation, adoption of fintech products also bears risks. According to Morgan, Huang, and Trinh (2019), in addition to traditional financial risks, use of digital financial services entails a variety of new risks. Such risks are more diverse and harder to spot than those associated with traditional financial products and services. These risks include phishing, pharming, spyware, and swaps. Furthermore, digital footprints may also be a source of risks. This suggests that higher financial literacy could also facilitate the use of fintech products and services.

As far as we are aware, no one has examined the relation between financial literacy and the awareness and adoption of financial technology. We conjecture that there is a positive correlation between financial literacy and the awareness and adoption of financial technology.

4. FINANCIAL LITERACY AND FINTECH IN VIET NAM

4.1 Measurement of Financial Knowledge

We adopt the questionnaire developed by OECD/INFE (2015a) to calculate scores for financial knowledge. The score for financial knowledge is calculated from seven survey questions reflecting the subject's understanding of basic financial knowledge, such as calculating interest rates, compound interest rates, risk and return evaluation, and understanding of inflation and risk diversification. The score ranges between 0 and 7. For ease of interpretation, we calculate a z-score for financial knowledge.

We also collect information on a large number of control variables that could also influence financial knowledge, including age, gender, education level, urban or rural, occupation, income, and debt.

4.2 Data Collection

The survey was conducted by Mekong Development Research Institute under the direction of the Asian Development Bank Institute. Data collection was conducted from June to August 2019. We use the sample from Viet Nam Housing Living Standard Surveys (VHLSS) 2018 as our base sample. Two big cities, Ha Noi and Ho Chi Minh, were selected purposely, while three other provinces located in the North (Bac Ninh),

Central (Quang Nam), and South (Dong Thap) were randomly selected. Samples in Ha Noi and Ho Chi Minh City are taken to represent urban areas, and samples from the other provinces are taken as representative of rural areas.

In these cities/provinces, we randomly selected VHLSS enumeration areas (EAs). In each EA, we attempted to interview 30 households as in VHLSS 2018. If a household that was in VHLSS 2018 was not available, we selected the household next to it to replace the missing one. About 50% of households could not be traced and were replaced by new households.

We interviewed the household head or those who had the fullest information on the household finances to answer general demographic and household economic information (including total household income, household debt, and assets). We randomly selected one household member who was at least 18 years old to answer our main sections on fintech and financial literacy (using dice and household member lists). In the case that the individual was not available at the interview time, we continued to randomly select an individual until we found someone available.

Our final sample includes 1,058 households, of which 45% are located in rural areas and 55% located in Ha Noi and Ho Chi Minh City.

4.3 Stylized Facts of Financial Knowledge

Figure 1 compares the average values of the scores for financial knowledge. On average the financial knowledge score in our sample is 4.4, 0.4 percentage points higher than the results in our earlier study (Morgan and Trinh 2019). This is partly due to the fact that half of our sample is in Ha Noi and Ho Chi Minh City, where the income and education levels are on average higher than for individuals in other provinces (previous literature has shown that income and education level are major determinants of financial literacy). In comparison with other countries, the financial knowledge of the Vietnamese is much lower than in some other Asian economies including the People's Republic of China and the Republic of Korea, but is not low when considered relative to per capita GDP. The figure shows that male respondents have higher financial knowledge than female respondents, although the difference is not large. People with higher income also have higher financial knowledge than people with lower income. It is interesting to note that while many other studies find that younger people tend to have lower financial knowledge scores, in our sample we find that the financial knowledge score is higher among younger persons than older individuals, especially those over age 60.

4.4 ICT Adoption and Financial Literacy

Almost all respondents report using a telephone. Moreover, about 63.3% of them used a smartphone (Figure 2). Men tend to use smartphones more than women (67.5% vs. 60.6%). While almost all young people (i.e., those aged less than 30) used a smartphone, only 62.9% of those aged from 30 to 60 and 40.3% of those aged more than 60 years used smartphones. The smartphone penetration rate also differs by household income group. While nearly 82% of people with income more than VND190 million use smartphones, the figure for those with income less than VND85 million is only 40.32%.
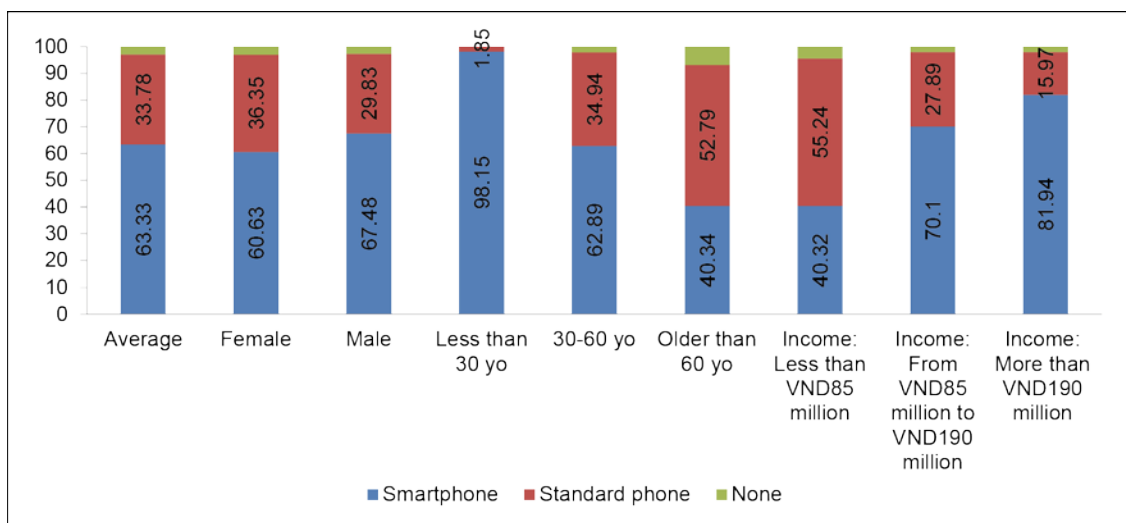
Figure 1: Financial Literacy Score of Different Groups
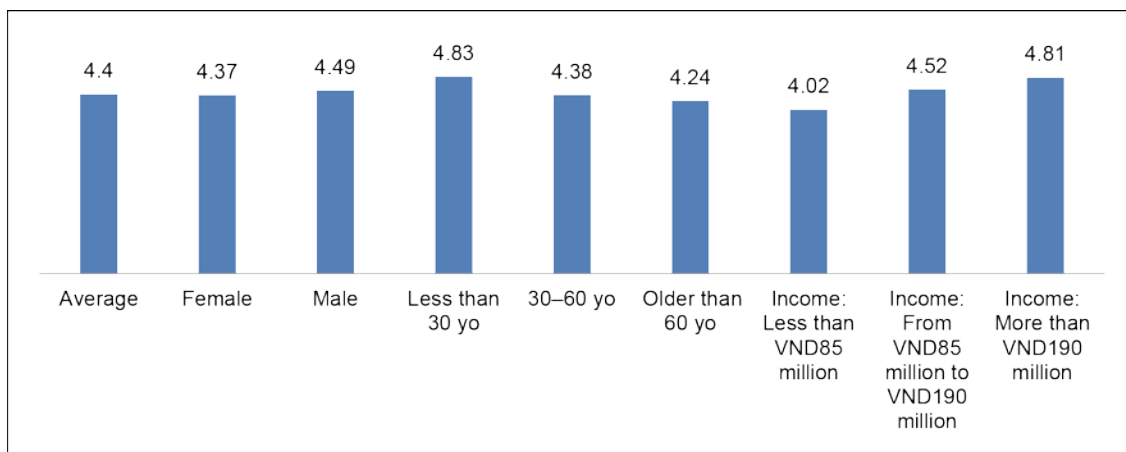
Note: yo = years old, VND = Viet Nam dong.
Source: Authors' calculation.

Figure 2: Telephone Penetration Rate in Viet Nam (%)

Note: yo = years old, VND = Viet Nam dong.
Source: Authors' calculation.

Figure 3 shows how holders of smartphones use them. Unsurprisingly, most smartphone users (more than 90%) use their smartphones to make phone calls or messages (through mobile apps), take pictures, and read news, while about 80% use smartphones for accessing social media. About half of smartphone users use them for online shopping and social shopping (mostly through Facebook). Only 9.5% use smartphones to manage their finances.

Figure 3: Smartphone Usage (% of Total Smartphone Users)
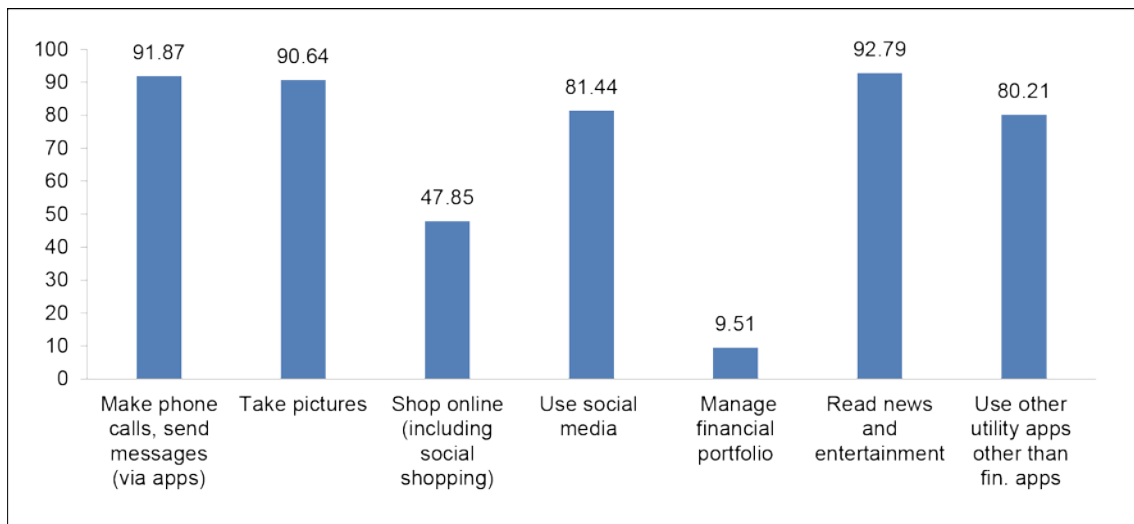
Source: Authors' calculation.

Figure 4: Awareness of Fintech Products (% of Total Respondents)

Source: Authors' calculation.

Figure 4 presents how respondents are aware of five major types of fintech services. The proportion of those who are aware of digital borrowing is much 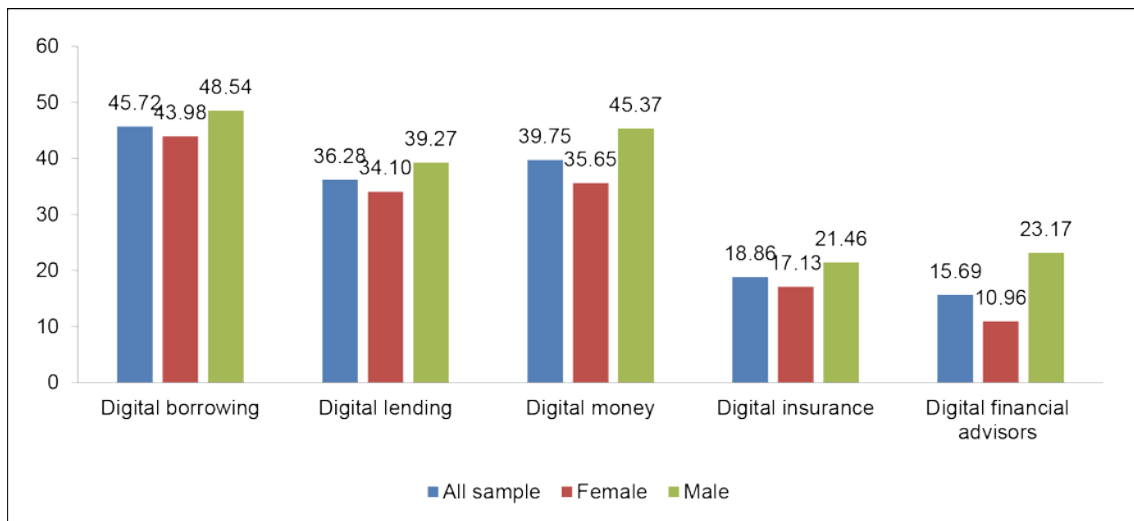higher than the proportion of those who are aware of other products. About 45.7% of respondents are aware of digital borrowing while the figures for digital lending and digital money (e-wallets) are 36.3% and 39.8%, respectively. Only 18.9% and 15.7% of respondents are aware of digital insurance and digital financial advisors, respectively. The data also indicates that for each type of digital finance men are more likely to be aware than women.

Figure 5: Awareness of Fintech Products, by Age Group
(% of Total Respondents)
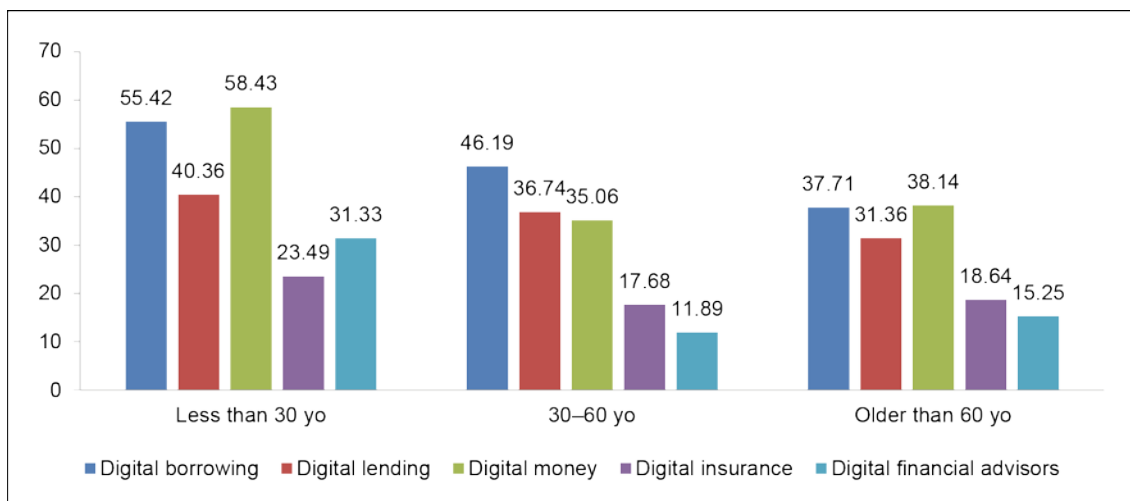
Note: yo = years old.
Source: Authors' calculation.

Figure 6: Awareness of Fintech Products, by Income Group
(% of Total Respondents)
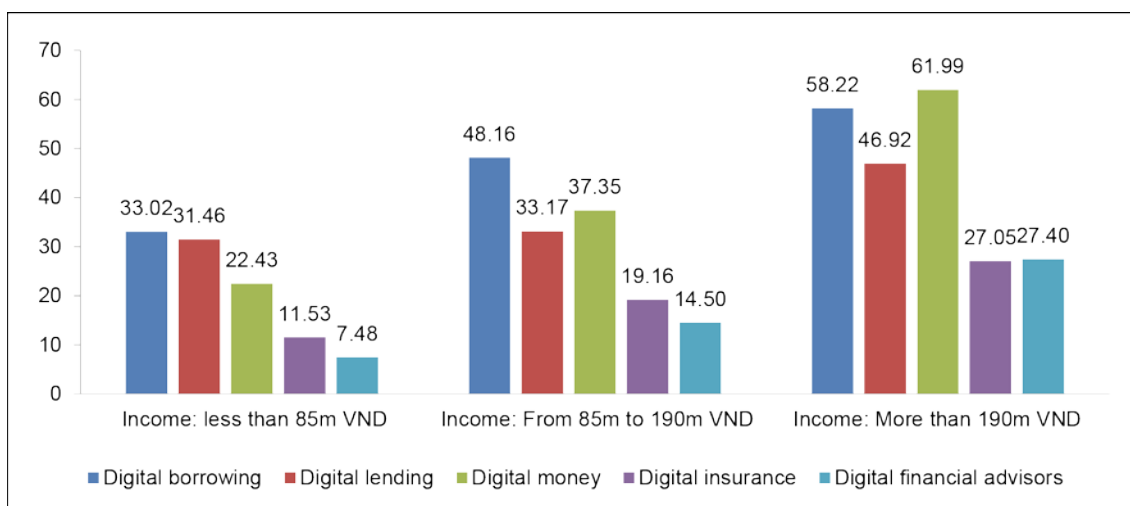
Note: VND = Viet Nam dong.
Source: Authors' calculation.

Since most of the fintech services adopted are related to payments and transfers, Figure 7 shows how respondents use methods of payment and fintech services to make their payments and transfers. Nearly all respondents (99.4%) still use cash for payment. Cash is also the major means of money transfer with 95.57% using cash for transfers. This suggests that cash is still the dominant means of transactions. Around 13% and 10% of respondents use credit/debit cards for payments and transfers, respectively. Only about 10% of respondents use mobile phones for transfers and payments and only 5% use computers for transfers and payments.

Figure 7: Payment Method (% of Total Respondents)
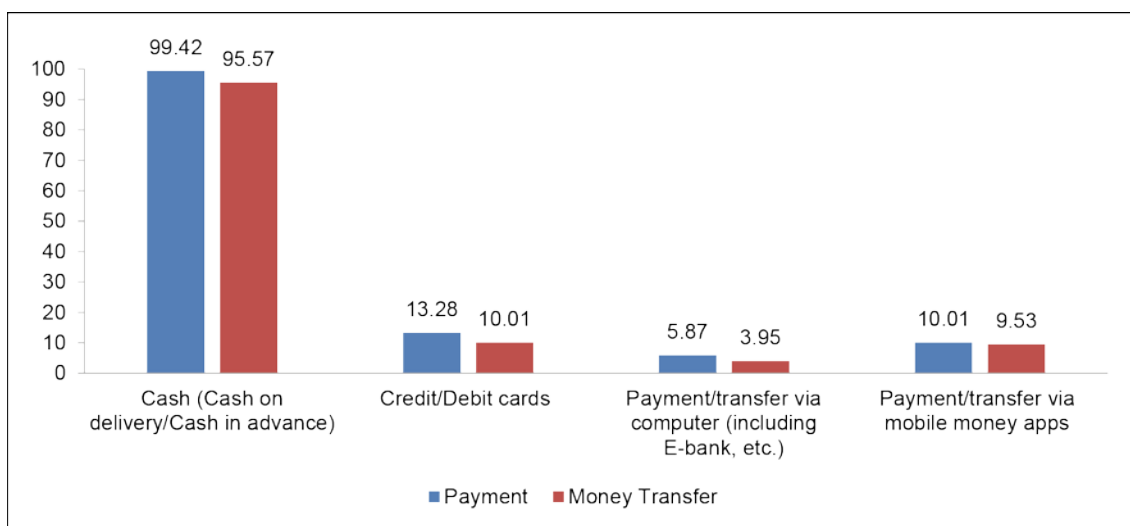
Source: Authors' calculation.

Figure 8: Adoption of Fintech Services, by Gender, Age, and Income
(% of Total Respondents)
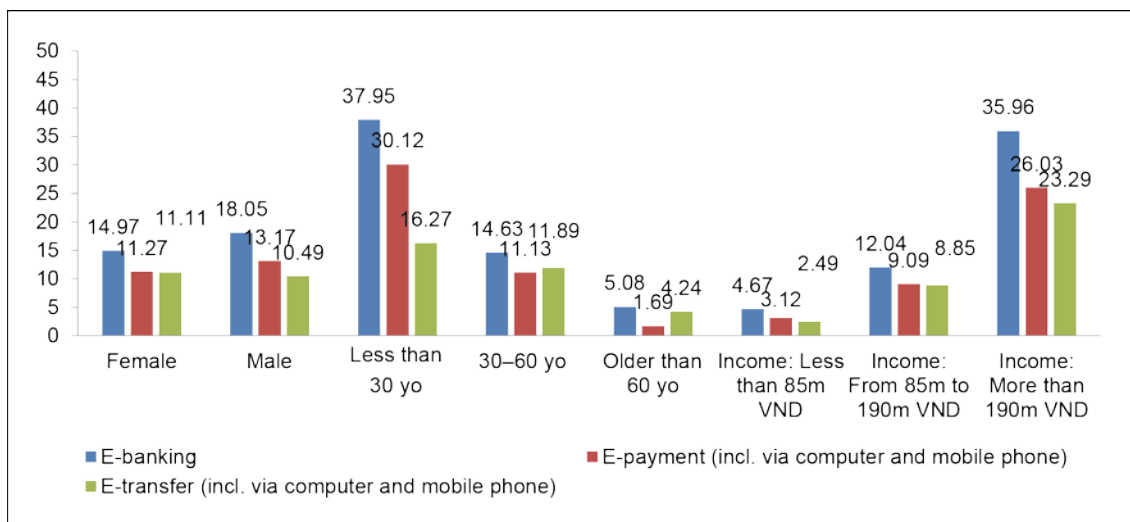
Note: yo = years old, VND = Viet Nam dong.
Source: Authors' calculation.

Figure 8 reports the adoption of fintech services by different groups of respondents. On average, men tend to adopt fintech services more than women, but the difference is quite small. For example, 18% of male respondents use an e-banking service, while the figure for female respondents is about 15%. The proportion of younger people (i.e., those aged less than 30 years old) using fintech services is much higher than that among older people, and the differences are rather large, especially between those aged less than 30 years old and those more than 60 years old. Less than 5% of those whose annual household income is less than VND85 million adopt at least one fintech service, while the figures for those with annual household income more than VND190 million are from 23% to nearly 36%, depending on the type of fintech service. The differences in fintech adoption rates between the top income group and the middle-income group are

also large. Only around 10% of those in the middle-income groups use at least one fintech service.

Figure 9 shows the financial literacy scores of those who adopted fintech services and those who did not. As expected, there is a positive relation between fintech adoption and financial literacy score. For example, individuals using e-banking services have an average financial score of 5.1 while that of non e-banking users is only 4.3.

Figure 9: Fintech Adoption and Financial Literacy Scores
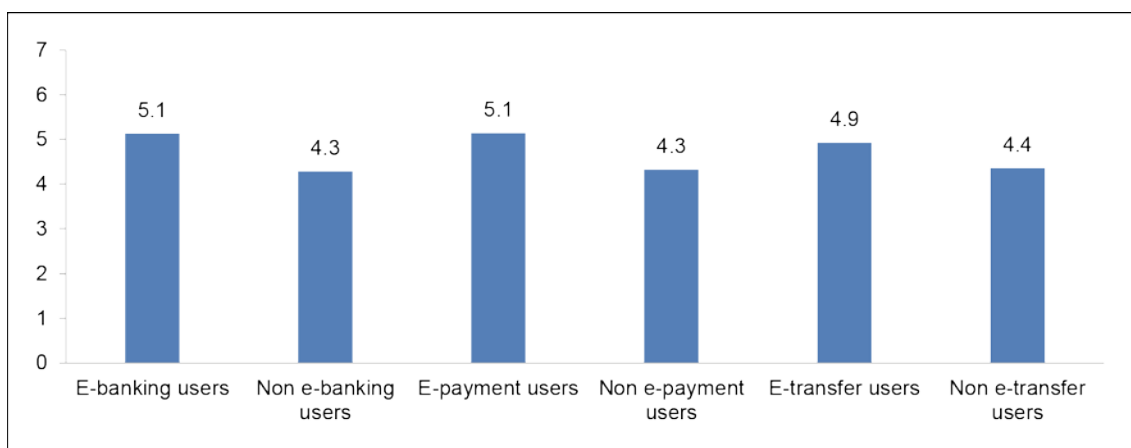
Source: Authors' calculation.

5. EFFECTS OF FINANCIAL LITERACY ON FINTECH AWARENESS AND ADOPTION

5.1 Empirical Approach

To quantify the effect of financial literacy on the awareness of fintech products, the following equation is estimated:

$$FtAware_i = \alpha_0 + \alpha_1 FL_i + X_i \alpha_2 + \epsilon_i \tag{1}$$

of which

- We use several indicators for the outcome variable, $FtAware_i$. First, we create separate dummy variables for individual $i's$ awareness of each digital service, i.e., digital borrowing, digital lending, digital money (i.e., e-wallet), digital insurance, and digital financial advisors. For each type of fintech service, the dependent variable takes the value of one if individual i is aware of its existence, and zero otherwise. Second, we construct an index of awareness from the information relating to the individual's awareness of each fintech service. The index ranges from zero to five, i.e., one for each fintech service that individual i is aware of. For ease of interpretation, we convert this to a z-score.

- FL_i is the financial literacy score. α_1 measures the effects of financial literacy on fintech awareness. For ease of interpretation, we also convert this indicator to a z-score.

- The control variables (X_i) include income level, individual's age, education level, gender, and provincial dummies. With regard to age, we divided the sample into three age groups: those under 30 years old (young people); those over 30 years old but under 40 years old; those over 40 and under 50 years old; those over 50 but under 60 years old; and those over 60 years old (old people). We used the group of young people as the base group. For educational level, we combined the categories into five groups: (i) those with some, completed, primary education (called the "Primary education" group); (ii) those with some, or completed, secondary education (called the "Up to secondary education" group); (iii) those with some or complete high school (called the "Up to high school education" group); (iv) those with some technical school or 3-year college graduation (called "Higher education" group); and (v) those with at least university degree (4-year college graduation) (called "University graduate and higher" group). We use the first group ("Primary education" group) as the reference group. We separate household income into four groups: those living in households with income less than VND85 million per year (i.e., equal to about 75% of total median income); those living in households with income from VND85 million to VND190 million; those with income of more than VND190 million (i.e., about 150% of total median income); and those who did not report their income. We use the group of people living in households with annual income less than VND85 million as the reference group.[3]

To estimate the correlation between financial literacy and fintech adoption, we use the following equations:

$$FtAdopt_i = \beta_0 + \beta_1 FL_i + X_i\beta_2 + \eta_i \tag{2}$$

The independent variables are similar to those in equation (1). Dependent variables are three dummy variables, which take the value of one if individual i uses one service (of three fintech services) and zero otherwise. The three fintech services that are available are (i) e-banking services; (ii) e-payment services; and (iii) e-transfer services. It should be noted that these three services are not exclusively excluded. One can use e-banking apps for e-payment or e-transfer. However, there are other fintech service providers that are not banks, so those who use e-payment or e-transfer may not use e-banking services.

Because the adoption of fintech services is only observed among those who are using the internet (either via mobile phone or computer), sample selection will lead to biased OLS estimates. To remedy the sample selection bias, we estimate equation (2) using the Heckman procedure.

$$FtAdopt_i^* = \gamma_0 + \gamma_1 FL_i + X_i\gamma_2 + \eta_i^* \tag{3}$$

Of which $FtAdopt_i^*$ is a latent variable, indicating whether individual i adopts the fintech or not. $FtAdopt_i^*$ is only observed if individual i uses the internet.

$$P(internet = 1|FL_i, X_i) = \Phi(\theta_0 + \theta_1 FL_i + X_i\theta_2 + \mu_i) \tag{4}$$

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[3] Although we prefer to use the specific amount of income per person, about 20% of households did not reveal their specific annual income. They reported their household's income within a certain range.

The Heckman two-step procedure will estimate equation (4) as the first state, then calculating the inversed Mills' ratio (IMR) and estimation equation (2) with IMR being controlled for.

It should be noted that our estimates could suffer from endogeneity biases. While possible reverse causality running from fintech adoption to financial literacy may not pose a big threat to our estimation since fintech has only recently been developed in Viet Nam, various unobservable factors may be correlated with both fintech adoption and financial literacy. To deal with this issue, the instrumental variable approach is appropriate. However, it is rather difficult to find suitable variables that are related to financial literacy but exogenous to fintech adoption. Therefore, our estimates should be interpreted cautiously.

5.2 Empirical Results

Table 2 reports our estimation results on the relationship between financial literacy and the awareness of five fintech products (digital borrowing, digital lending, digital money, digital insurance, and digital financial advisor) and our fintech awareness index. The result in Table 1 shows that financial literacy is positively associated with the likelihood of awareness of most fintech products. A one-standard deviation increase in the financial literacy score is associated with an increase in the probability of awareness of digital borrowing by 5.2 percentage points; of digital lending by 3 percentage points; digital payment by 3.6 percentage points; and by digital insurance by 1.6 percentage points. A one-standard deviation increase in financial literacy also increases our awareness index by 9 percentage points. However, financial literacy does not have a correlation with awareness of digital financial advisors. This result is consistent with previous results. Morgan and Trinh (2020) found that one-standard deviation increase in financial literacy raises the awareness of at least one fintech product by 8 percentage points in the Lao PDR.

The result also suggests that those living in households with annual income higher than 190 million Vietnamese dong (VND) have a higher likelihood of being aware of fintech products (except for digital insurance) than those with income lower than VND85 million (the reference group), while there is no statistically significant difference in awareness of any fintech products between the reference group and those with incomes from VND85 million to VND190 million. This result suggests that only a proportion of high-income people are more likely to know about fintech products. Even when financial literacy and income are controlled for, individuals with higher education levels have a significantly higher likelihood of awareness of fintech products. For example, an individual with at least university degree education tends to have a higher probability of awareness of digital borrowing than those with only primary education by about 18 percentage points. The likelihood of awareness of some fintech services such as digital lending and digital financial advisors among those with secondary school education are no different from those with primary education. Especially for digital financial advisor, only those with at least college education have higher likelihood of awareness than those in the reference group, while there is no difference in the awareness between those with secondary education and high school education and those with primary education.

Our estimation results also show that, after controlling for education level and income level, the likelihood of awareness of some fintech products such as digital lending and digital insurance is not statistically significantly related to age groups and gender. Meanwhile, for digital borrowing, people aged more than 60 are less likely to be aware than those who are under 30, while there is no difference among those who are over 30

and those who are under 30 years old. The results also show that individuals who are over 40 (over 30) are less likely to be aware of digital payments (digital financial advisor) than people who are less than 30 years old. This may partly be due to higher exposure to new information for those who are under 30 than people in other age groups. Female and male individuals show no difference in awareness of fintech products, except for two products, digital payment and digital financial advisor.

Table 2: Effect of Financial Literacy on Awareness of Fintech Products

	(1)	(2)	(3)	(4)	(5)	(6)
	Digital Borrowing	Digital Lending	Digital Payment	Digital Insurance	Digital Advisor	Awareness Index
Financial knowledge	0.052***	0.030***	0.036***	0.016*	0.006	0.090***
	[0.011]	[0.011]	[0.009]	[0.008]	[0.007]	[0.020]
Age: 30–39 yo	0.088	0.057	−0.054	−0.007	−0.106**	−0.014
	[0.054]	[0.055]	[0.046]	[0.045]	[0.043]	[0.095]
Age: 40–49 yo	−0.015	0.033	−0.097**	0.038	−0.132***	−0.111
	[0.053]	[0.053]	[0.042]	[0.044]	[0.040]	[0.092]
Age: 50–59 yo	−0.065	−0.049	−0.147***	−0.018	−0.140***	−0.270***
	[0.053]	[0.052]	[0.042]	[0.041]	[0.039]	[0.090]
Age: Over 60 yo	−0.100*	−0.048	−0.124***	−0.003	−0.116***	−0.252***
	[0.052]	[0.051]	[0.042]	[0.043]	[0.042]	[0.095]
Male	0.040	0.042	0.081***	0.041	0.115***	0.205***
	[0.030]	[0.030]	[0.025]	[0.025]	[0.023]	[0.056]
Income: VND85m–190m	0.057	−0.024	−0.009	0.015	0.018	0.037
	[0.037]	[0.036]	[0.031]	[0.028]	[0.024]	[0.067]
Income: >VND190m	0.093**	0.075*	0.091**	0.038	0.080**	0.243***
	[0.043]	[0.043]	[0.036]	[0.035]	[0.031]	[0.079]
Income: Not reported	−0.063	−0.097	−0.054	−0.043	−0.032	−0.186
	[0.080]	[0.079]	[0.072]	[0.063]	[0.048]	[0.161]
Education: Up to secondary	0.081*	0.065	0.071**	0.055**	−0.008	0.170**
	[0.043]	[0.044]	[0.031]	[0.027]	[0.019]	[0.072]
Education: Up to high school	0.149***	0.100**	0.163***	0.067*	0.027	0.325***
	[0.049]	[0.049]	[0.038]	[0.034]	[0.025]	[0.083]
Education: Higher education	0.226***	0.180***	0.370***	0.183***	0.196***	0.744***
	[0.061]	[0.062]	[0.052]	[0.051]	[0.045]	[0.116]
Education: College and higher	0.176***	0.139**	0.493***	0.148***	0.229***	0.763***
	[0.059]	[0.060]	[0.047]	[0.048]	[0.043]	[0.107]
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	0.160**	0.199**	0.237***	0.056	0.130**	−0.500***
	[0.079]	[0.079]	[0.064]	[0.064]	[0.054]	[0.141]
R-sq	0.137	0.071	0.370	0.089	0.183	0.284
N	1,058	1,058	1,058	1,058	1,058	1,058

Note: Figures in bracket are standard errors. ***, **, and * denote coefficient is statistically significant at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimates.

We also explore whether financial literacy is correlated with adoption of fintech services or not. Adoption of fintech products could be observed for those who had access to the internet. Using the OLS estimation method may give a biased estimation due to the sample selection issue. Therefore, we estimate this relationship using the Heckman two-step procedure.[4] Table 3 presents our estimation results. Columns 1–3 are three dummy variables which indicate the adoption of three services: e-banking services, e-payment, and e-transfer. Column 4 is the first stage estimation results from estimating the probability of access to the internet.[5] From the first stage, the inversed Mill's ratio is calculated and is added as an additional control variable in the second stage. Our estimation results show the estimates of inversed Mills' ratio variables are statistically significant in all three 2nd stage equations, implying that control for sample bias is important to have better estimates of the relationship between financial literacy and fintech adoption.

Our estimation results show that financial literacy is positively correlated with adoption of some fintech products. For example, a one-standard deviation increase in the financial literacy raises the likelihood of using e-banking services by 4.1 percentage points and the likelihood of using e-payment services by 3.9 percentage points. However, financial literacy is not correlated with using e-transfer services.

With regards to other control variables, our results suggest that those with higher income tend to use fintech services more than those with lower income. However, the relationship is only statistically significant for those living in households with annual income higher than VND190 million, i.e., their likelihood of using fintech services is statistically significantly higher than that of those from households with annual income less than VND85 million. People with higher education are also more likely to use fintech services than those having lower education. For example, individuals with at least university degree education have higher likelihood of using e-banking than those with primary education by 80%. The figures for those with higher education, high school education, and secondary education are 64.1, 39.7, and 22 percentage points. We also observed the same pattern for other fintech products.

While age does not affect the awareness of fintech products, it is correlated with the use of fintech services. Generally, the likelihood of using fintech products among younger people is higher than that among older people. For example, people over 60 years old have lower likelihood of using e-banking than those under 30 years old by 65.5 percentage points. The figures for people from 50 to 59 years old and from 40 to 49 years old are 51.6 and 22.4 percentage points. There are some differences among those from 30 years old to 40 years old and those under 30 years old, but these differences are small and only statistically significant at the 10% level. Our results also suggest that men are more likely to use fintech services (e-banking and e-payment) than women.

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[4] Please refer to Appendix 1 for the OLS estimation results.

[5] It would be ideal to have exogenous variables which are correlated with access to the internet but not related to the decision to adopt fintech products. There are several for this including internet development, and telecom development at the provincial level.

Table 3: Effects of Financial Knowledge on Fintech Adoption:
Heckman Two-step Procedure

	(1)	(2)	(3)	(4)
	e-Banking	e-Payment	e-Transfer	First Stage
Financial knowledge	0.041**	0.039**	0.000	0.151***
	[0.016]	[0.015]	[0.013]	[0.041]
Age: 30–39 yo	−0.108*	−0.101*	0.034	−0.182
	[0.056]	[0.054]	[0.043]	[0.222]
Age: 40–49 yo	−0.224***	−0.208***	0.021	−0.794***
	[0.059]	[0.057]	[0.046]	[0.206]
Age: 50–59 yo	−0.516***	−0.459***	−0.140**	−1.528***
	[0.082]	[0.079]	[0.067]	[0.205]
Age: Over 60 yo	−0.655***	−0.606***	−0.228***	−1.811***
	[0.087]	[0.084]	[0.071]	[0.211]
Male	0.089**	0.069*	−0.006	0.518***
	[0.038]	[0.036]	[0.030]	[0.172]
Income: VND85m–190m	0.077	0.077	0.051	0.379***
	[0.054]	[0.053]	[0.045]	[0.123]
Income: > VND190m	0.289***	0.225***	0.165***	0.598***
	[0.060]	[0.058]	[0.050]	[0.148]
Income: Not reported	−0.163	0.027	−0.059	−0.193
	[0.116]	[0.112]	[0.096]	[0.286]
Education: Up to secondary education	0.220**	0.182**	0.124	1.152***
	[0.088]	[0.085]	[0.079]	[0.183]
Education: Up to high school	0.397***	0.376***	0.247***	1.810***
	[0.107]	[0.103]	[0.092]	[0.239]
Education: Higher education	0.641***	0.570***	0.385***	2.075***
	[0.122]	[0.118]	[0.104]	[0.252]
Education: College & higher	0.807***	0.666***	0.458***	0.314***
	[0.126]	[0.122]	[0.107]	[0.107]
Province dummies	Yes	Yes	Yes	Yes
Intercept	−0.476***	−0.445***	−0.186	−0.536*
	[0.173]	[0.167]	[0.145]	[0.313]
Mills				
λ	0.480***	0.463***	0.180*	
	[0.108]	[0.105]	[0.095]	
N	631	631	631	1,058

6. CONCLUSIONS AND RECOMMENDATIONS

This study is one of the first to examine the relationship between financial literacy and awareness and adoption of fintech products and services in the context of developing countries. We use our newly collected data on financial literacy and fintech adoption in Viet Nam. We examine whether higher financial literacy could improve the awareness of five fintech products (digital borrowing, digital lending, digital payment, digital insurance, and digital financial advisor) and raise the level of our own awareness index. We also examine the correlation between financial literacy and the adoption of fintech services (e-banking, e-payment, and e-transfer).

Our empirical results show that financial literacy is correlated with the awareness of almost all fintech products (except for digital financial advisors) and of our awareness index. It also correlates with the adoption of two fintech services (e-banking and e-payment). Our results also show a positive relationship among income, education level, and fintech awareness and fintech adoption. While age does not affect awareness of some fintech products, it has a negative correlation with fintech adoption. Older people have lower likelihood of using fintech products. We also find that people living in Ha Noi and Ho Chi Minh City are more likely to be aware and adopt fintech services than people living in other provinces.

Not only does the low level of financial literacy explain the low level of awareness and adoption of fintech products; it is also related to the underdeveloped state of ICT infrastructure in the country. Therefore, in addition to general and financial education programs, the country needs to put more effort into the development of ICT infrastructure as a necessary condition for fintech development.

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APPENDIX 1: FINANCIAL KNOWLEDGE AND FINTECH ADOPTION: OLS ESTIMATION

	(1)	(2)	(3)
	e-Banking	e-Payment	e-Transfer
Financial knowledge	0.009	0.008	−0.002
	[0.007]	[0.007]	[0.006]
Age: 30–39 yo	−0.106**	−0.088**	0.025
	[0.043]	[0.042]	[0.039]
Age: 40–49 yo	−0.141***	−0.123***	0.029
	[0.040]	[0.038]	[0.035]
Age: 50–59 yo	−0.234***	−0.193***	−0.032
	[0.037]	[0.035]	[0.032]
Age: Over 60 yo	−0.292***	−0.258***	−0.088***
	[0.037]	[0.035]	[0.031]
Male	0.026	0.018	−0.011
	[0.020]	[0.019]	[0.019]
Income: VND85m–190m	−0.022	−0.015	0.010
	[0.020]	[0.017]	[0.016]
Income: > VND190m	0.133***	0.094***	0.101***
	[0.028]	[0.025]	[0.025]
Income: Not reported	−0.073**	0.017	−0.006
	[0.037]	[0.043]	[0.042]
Education: Up to secondary education	−0.025	−0.033**	−0.010
	[0.016]	[0.013]	[0.013]
Education: Up to high school	−0.002	−0.001	0.047**
	[0.022]	[0.020]	[0.021]
Education: Higher education	0.154***	0.123***	0.146***
	[0.041]	[0.038]	[0.037]
Education: College & higher	0.309***	0.203***	0.230***
	[0.041]	[0.038]	[0.039]
Provincial dummies	Yes	Yes	Yes
Intercept	0.221***	0.194***	0.064
	[0.051]	[0.048]	[0.046]
R-sq	0.349	0.256	0.171
N	631	631	631